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CASCADE BRIDGE
Iowa Bridges Recording Project
Spanning Cascade Ravine
at S. Main Street
Burlington
Des Moines County
Iowa

HAER No. IA-50

BLACK & WHITE PHOTOGRAPHS

WRITTEN HISTORICAL & DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Department of the Interior
P.O. Box 37127
Washington, D.C. 20013-7127

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CASCADE BRIDGE

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Location:	Spanning Cascade Ravine on South Main Street, Burlington, Des Moines County, Iowa. UTM: 15.660460.4516000 USGS: Burlington, Iowa quadrangle (7.5 minute series, 1976)
Date of Construction:	1896
Designer:	Boynton & Warriner, Cedar Rapids, Iowa
Fabricators:	Milwaukee Bridge and Iron Works, Milwaukee, Wisconsin; Carnegie Steel Company, Pittsburgh, Pennsylvania
Present Owner:	City of Burlington
Present Use:	City street bridge
Significance:	This bridge, a combination of pinned Pratt trusses and a pinned Baltimore truss, is a unique type for Iowa. It is in relatively good and unaltered condition for such an old urban bridge in daily use. A product of the joint construction efforts of the City of Burlington and the Milwaukee Bridge and Iron Works, this bridge is a well preserved example of the work of a firm that was in business for a quarter century (until its absorption by American Bridge Company), but about which relatively little is known.
Historian:	Robert W. Jackson, August 1995
Project Information:	This document was prepared as part of the Iowa Historic Bridges Recording Project performed during the summer of 1995 by the Historic American Engineering Record (HAER). The project was sponsored by the Iowa Department of Transportation (IDOT). Preliminary research on this bridge was performed by Clayton B. Fraser, Fraserdesign, Loveland CO.

Early in 1896, civic leaders in Burlington were making plans to celebrate Iowa's first fifty years as a state. The center of the community's celebration was to be Crapo Park, the partially completed ninety-seven acre site located just south of the city. Although the park had been dedicated in 1895 it still lacked water, a road system, and easy access from the city. Knowing that the park needed improvement in order to serve as a suitable celebration site, several members of the Burlington Citizen's Association went to Des Moines seeking funds for the anticipated celebration. Their efforts were rewarded in February 1896 when the State Legislature generously allocated $10,000 to help pay for Semi-Centennial expenses, with the stipulation that the Burlington festivities be held before the end of the year but after September 1. The Legislature's concern was that the city's activities should not conflict with the State Fair. A portion of this state allotment was used to build the Crapo Park Coliseum, a facility that would eventually have the capacity to accommodate 10,000 people. Design of the park road system was also begun in 1896, even though park roads would not be complete in time for the Semi-Centennial. However, the most pressing problem in terms of making the park usable for celebrants was the lack of an adequate means of access to the park for large numbers of people. The streets of Burlington at this time were generally unpaved and frequently impassable in bad weather, and the electric trolley lines did not yet extend to the park.[1]

The Burlington street railway system began to be electrified in 1891, but for the most part the new cars continued to run on the same rails, and along the same streets, as had the earlier horse-drawn cars. Improvements, such as grading and obstacle removal, were necessary to convert a street into a adequate trolley line. In 1896, at the same time that plans were being made for the Semi-Centennial, the Burlington Electric Railway Company was acquired by the Burlington Light & Railway Company, controlled by the Walsh interests, with M.A. Walsh as president. Walsh was

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[1]Unless otherwise noted, information concerning the creation of Crapo Park and plans for the creation of Cascade Bridge is taken from the following sources: City of Burlington Council Record 19, 295 (6 April 1896); 303, 317, 319 (20 April 1896); 320 (27 April 1896); 324, 327, 337-339 (4 May 1896); 357 (18 May 1896); located in the Des Moines County Courthouse, Burlington, IA; Steven Jacobsen, "Inspection of the Cascade Bridge over Cascade Ravine," a report prepared for the City of Burlington, Iowa by NNW, Consulting Engineers, Iowa City, Iowa, March 1995, 3-5, located at the City Engineer's Office, City of Burlington, IA.; Hamilton Kirk Watkins, ed., A Souvenir of Burlington (Burlington,IA: The Journal, 1896) 46.

aggressive in his desire to extend the lines of the company, including service to Crapo Park.[2]

The City Council recognized that a new line to the park was needed to handle large crowds. The problem was where to put the line. Three possible routes were considered: Ft. Madison Road, which would require the removal of many old trees that were valued by the community; a line on a new street, beginning opposite Prospect School and terminating in the center of the park; and a line down Main Street, which would require bridging Cascade Ravine. The Fort Madison Road route was quickly discarded due to strong opposition such as that expressed by Hamilton Kirk Watkins, who wrote:

> The route by which the electric railway should reach the park should be by some street east of the Ft. Madison Road. The city council should insist upon this point. The finest drive in Des Moines County should not be destroyed by appropriating it to the use of the street railway. Another road will do just as well, or better, for the street cars as this, but it would take a lifetime to make another such a pleasant drive. The grand trees which border the road have been 40 years in the growing. They afford shade and comfort for driving in the heat of the day, and if the road is free from the annoyance of the electric cars it will be a favorite drive for hundreds of women and children who will frequent the park in the busy hours of the day when men are at their work--adding greatly to the park's cheerfulness and attraction.[3]

Others, including former city engineer William Steyh and one of the local papers, the Burlington Hawk Eye, were in favor of a new line, on a new street, keeping Main Street as a boulevard. But Philip Crapo was concerned that obtaining the necessary right of way for a streetcar line down a new road would take too long for the line to be put in service by the opening of the Semi-Centennial. The condemnation proceedings to secure the land for the park had already taken longer than anticipated, and Crapo did not want to jeopardize the success of the celebration by delays. With support from the Gazette, he pushed hard for the extension of a route down Main Street. During the City Council meeting of April 6, 1896, the council adopted a resolution put forth by Crapo stating that "it is of the utmost importance that the

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[2]Lloyd Maffitt, "Horses, Mules Pulled First Streetcars Here," Hawk Eye (Burlington, IA), 9 March 1975, 24-25.

[3]Watkins, 46.

Council should decide at once by what line the Electric Cars are to reach Crapo Park, as the improvements in the park will depend to some extent on this decision, and the work cannot be prosecuted to advantage until this question is settled."[4]

Although time was growing short, the council was having difficulty arriving at the decision which Crapo had advocated. One of the questions which had to be resolved before the Main Street alternative could be agreed upon was the cost of a bridge across the ravine. On April 20, 1896, the same day that the council appointed a Semi-Centennial Commission to act in concert with the State Commission, it was resolved that the city engineer

> Ask for specifications and estimates of the cost of constructing a steel bridge not more than 400 feet nor less than 240 feet in length over the ravine on South Main Street known as the Cascade; said bridge to be of sufficient width to accommodate a double line of street cars and built in such a manner as to permit vehicles of all kinds to travel in opposite directions on said street car tracks, and to have sidewalks on either side not less than 6 ft. in width for foot passengers.[5]

On April 27th the council was again urged to act expeditiously to extend the road to the park via Main Street, and an April 6th petition by the Cascade Lumber Company to bridge the ravine was presented. Mr. T.R. Warriner, "a bridge builder and engineer," informed the council that the cost of the proposed bridge would be about $16,000 and that it could be put in place from 70 to 90 days from the date of contract. Finally, the council acted on May 4th, resolving to build the recommended bridge before September 1. The Internal Improvement Committee was instructed to begin improvements associated with the bridge, and the city engineer was authorized to employ a consulting engineer to prepare bridge plans. Approval for bid advertisement followed at the council meeting of May 18th, and bids were presented to council on June 2nd. The bids were reported by the city clerk as follows:

> For the bridge complete, ready for public travel, substructure and superstructure;
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> | | |
> |---|---|
> | Groton Bridge and Manufacturing Company | $15,975 |
> | Youngstown Bridge Company | $22,416 |
> | Clinton Bridge and Iron Works | $19,156 |
> | Penn Bridge Company | $20,888 |

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[4]City of Burlington Council Record 19, 295.

[5]Ibid, 303.

For the superstructure and trestle towers, not including hand rail;

James B. Diver & Company	$12,950
Milwaukee Bridge and Iron Works	$13,900

For the substructure of stone masonry, ready for the metal work;

W.H. Park and Company	$8.70 per cubic yard. Louisville cement
A.S. Young	$7.20 per cubic yard with brick facing and $12.00 per cubic yard with Dimention stone
Zach Schropp	$7.50 per cubic yard

For the substructure of brick masonry;

W.H. Park and Company	$12.75 per thousand. Louisville cement
A.S. Young	$18.00 per thousand. A01. Paving Brick
Zach Schropp	$24.85 per thousand

The council met as a committee of the whole, in closed session, with the city solicitor and engineer immediately after the regular council session to discuss the awarding of a contract.[6] On June 4 a representative of the Groton Bridge and Manufacturing Company "believing that there had been some misunderstanding," submitted a letter and addressed the council to reassure them that his firm could deliver the bridge by the September 1 deadline and, being the low bidder, should be awarded the contract. The committee of the whole, however, recommended, and the council subsequently decided, that the substructure should be made of concrete and built by the city under the direction of city engineer S.D. Eaton, with such assistance as he may employ, and that the city contract with the Milwaukee Bridge and Iron Company for the superstructure. The contract price was $13,900, which did not include handrails. This action was approved on a five to four vote, even though the chosen firm was not the low bidder for the superstructure. The James B. Diver Company of Keokuk, Iowa came in with a bid that was $950 lower for the same work. Moreover, the bond furnished by the Milwaukee Bridge and Iron Company was only $7,000, approximately half of the contract price.[7]

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[6]Ibid, 379-381.

[7]Ibid, 381-383, 388, 404.

The funds for substructure construction were to come out of the bridge fund, and the labor was to be performed by the street commission. Mr. T.R. Warriner, of the Cedar Rapids firm Boynton and Warriner, was employed to superintend the building of the bridge for the sum of $350.

The successful bidder for the superstructure, the Milwaukee Bridge and Iron Works, was the successor to a small business established in 1870 by Leon Soulerin and Garth W. James. Soulerin, who had patented an unusual draw bridge in 1874, dropped out of the company in 1876. James also dropped out in 1877, and F.S. IIsley briefly took over the reins of the company in that year. During IIsley's tenure the company built many bridges in Wisconsin, as well as in Mississippi and Iowa.[8]

In 1878, a partnership was purchased by William H. Keepers, a native of Ohio, who had joined the firm as superintendent in 1874. With Edinburgh, Scotland native and former company engineer James H. Cunningham as the other partner, the firm became known as Cunningham and Keepers until 1881, when Cunningham retired and Augustus T. Riddell took his place. In 1887 the firm was incorporated as the Milwaukee Bridge and Iron Works, with Keepers as president and Riddell as vice president, even though the company was apparently operating under that name prior to incorporation. The capital stock of the company at the time of incorporation was placed at $125,000, but rapid expansion in the next few years required the erection of new shop facilities and resulted in $800,000 worth of business in 1889. In that year the company closed or signed contracts for work in Wisconsin, Ohio, Michigan, Nebraska, Colorado, Indiana, Minnesota, the Dakotas, Texas and Iowa, including the Mississippi River span at Muscantine.

In 1892, a long time Milwaukee iron manufacturer named Julius G. Wagner took over the company, maintaining control until the firm was combined with twenty three other companies to form the new American Bridge Company in 1900. At the time the company received the contract for the Cascade Bridge, it had an annual

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[8]Information concerning the Milwaukee Bridge and Iron Works has been obtained from the following sources: George M. Danko, "The Development of the Truss Bridge, 1820-1930: With A Focus Toward Wisconsin," a document prepared by the State Historic Preservation Office, State Historical Society of Wisconsin, 27 August 1976; George M. Danko, "A Selective Survey of Metal Truss Bridges In Wisconsin," a document prepared by the Historic Preservation Division, State Historical Society of Wisconsin, 26 August 1977; Incorporation Index, Milwaukee County Historical Society, Milwaukee, WI, A:306: O:252; Q:348, 601.

operating capacity of approximately 8,000 long tons. The Burlington contract, therefore, represented a very small part of the firm's business for that year.

Despite receiving injunction proceedings to prevent the building of the bridge on June 15 (subsequently denied by the court), the Burlington city council proceeded with their plans. They negotiated an additional agreement with Milwaukee Bridge and Iron Company for a hand rail at a price of $1.30 per lineal foot, and awarded a contract with the Burlington Electric Street Railway Company for a double-track line over the bridge to Crapo Park. Construction was ordered to begin on June 15 with assistant city engineer Emmet Steece in direct charge.[9]

According to Steece, the piers and abutments were built entirely of concrete in accordance with the ordinary methods of the time, except for the last abutment. All except this abutment were finished by August 15 and work on the last abutment was begun on August 17. Because it was desired that all work appear the same, and given that the time for beginning the metal work of the superstructure was rapidly approaching, a method of speeding the work on the last abutment was devised. The previous method of depositing and tamping concrete in 6 to 8" layers consumed a great deal of time, and it was also feared that to attempt to increase the depth of the layers was to endanger the integrity of the substructure. The method devised by Steece allowed for completion of the last abutment in seven days.[10]

As described by Steece, the methodology was as follows. Concrete, made of one part cement to two and one-half parts of sand and four and one-half parts of broken stone, was first deposited in a 4" layer. Upon this bed were laid, in a full bed of mortar, wetted rough stone, with the points and projections broken off; the spaces between these stones were not less than 6" wide nor less in width than two-thirds the thickness of the thickest stone at the joint. The concrete was then rammed into these spaces and the whole was covered with another layer of concrete not less than 4" thick. Twenty-eight men were able to deposit forty to fifty cubic yards of concrete in a ten-hour working day using this method.

On September 8, the council was presented with a letter from the Milwaukee Bridge and Iron Works stating that they had delivered

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[9]City of Burlington Council Record 19, 426 (20 July 1896); 446-447 (4 August 1896), 448-449 (5 August 1896).

[10]"Stone Filled Concrete Pier," Engineering News (17 December 1896), 396-397.

all the materials for the bridge and were, according to contract, entitled to payment of fifty percent of the contract price. Work on the bridge was completed on September 15, and on September 21 the council was presented with an invitation by the officials of the Burlington Electric Railway Company to be their quests on the initiation trip across the new structure. The invitation was accepted, even though all work on the rail line was not concluded until September 26.[11]

As completed, the bridge is about 464′ long and composed of four spans consisting of three different types of pin-connected deck trusses stretching about 90′ above the ravine. Beginning at the south abutment, there are two approximately 90′ Pratt trusses, each having five panels of about 18′ each, with a depth from top pin to bottom pin of about 18′. These two spans are supported and separated by a steel trestle pier on concrete footings founded on rock and stone. The gap between the two trusses is 15′-9".[12]

The third span is an approximately 204′ Baltimore truss consisting of twelve panels of about 17′ each, with a depth from top pin to bottom pin of about 30′. This span crosses the deepest part of the ravine and is supported on the south end by a steel trestle on concrete footing founded on rock and stone, and is supported on the north side by a concrete pier resting on rock and stone. There is no gap between this span and the adjacent spans.

The span which rests on the north abutment is an approximately 60′ Pratt truss, with four panels of about 15′ each. The depth from top pin to bottom pin is about 18′.

The floor system was composed of a laminated timber deck on top of steel stringers and steel floor beams. The original configuration featured steel rails for the double-track streetcar line, but steel plates were bolted to the timber in the wheel lanes after the streetcar service was discontinued.

On October 9 1896, the council was presented with the bill for balance due the Milwaukee Bridge and Iron Works for work on the bridge superstructure in the amount of $8,214. Assuming that the

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[11]City of Burlington Council Record 19, 460 (8 September 1896); 477 (21 September 1896); Jacobsen, 5.

[12]Information concerning the structure and present condition of the bridge is taken from: Jacobsen, 6-15; inspection by the author, 27 June 1995; and interview with City of Burlington Engineer Bob Karhoff, 27 June 1995.

company had already been paid 50% of the amount due in September, it seems that the addition of a handrail and other unspecified work to the contract pushed the final cost of the superstructure to $16,428. At a special meeting of the council on Saturday, October 24, the city auditor was directed to draw the necessary warrant to pay the bill.[13]

Because the money for the substructure came out of the bridge fund, and the labor for erection of the substructure was performed by the street commission, it is unknown exactly what this component of the total bridge cost might have been. Assistant city engineer Steece reported that the cost of the 278.2 cubic yards of masonry for the last abutment alone, including labor but not counting excavation nor the lumber used in the forms, was $1,235.21.[14] According to an undocumented March 1995 inspection report to the City of Burlington conducted by NNW, Inc. of Iowa City, the final cost of the bridge was $24,020.[15] Whatever the exact final cost of the bridge may have been, it is clear that a substantial commitment was made by the community in order that the Semi-Centennial be a success.

The Burlington Electric Railway Company, which had begun regular service down Main Street and across the new bridge to Crapo Park on September 28, was directed by the council in October to remove their poles from the center of the bridge to the outside of the walks. This danger to "human limb and life" being disposed of, the Main Street line over the new bridge served Burlington well, even though only one track was operational for the official opening of the Semi-Centennial on October 1.[16]

Buses began to replace Burlington's streetcars in 1925, with the last run being made on Saturday, July 13, 1929. On that day hundreds of the city's citizens turned out to see two of the company's oldest cars make one last run to Crapo Park over the Cascade Bridge. As the Burlington Hawk Eye reported, "the last ride to Crapo park marked an epic of transportation in Burlington."[17]

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[13]City of Burlington Council Record 19, 493-497 (9 October 1896), 504 (24 October 1896).

[14]Engineering News, 396.

[15]Jacobsen, 5.

[16]City of Burlington Council Record 19, 500, 502 (21 October 1896); Jacobsen, 5.

[17]Maffitt, 25.

In 1953, there was replacement of some truss bearings, repair of the concrete footings, and strengthening of some of the truss members and joints. Structural members were welded together at the lower joints at this time, thus altering the original character of the pinned connections. Ned Ashton of Iowa City served as consulting engineer for this work.

Other repairs and alterations took place in 1964, including replacement of the original laminated timber deck with the open-grid steel deck that is presently in place. This deck, which was chosen for lightness and strength, has allowed the salty water used for road de-icing to seep down onto the structural members, thus accelerating corrosion. Currently, the City of Burlington is considering solving this problem by completely welding all pin-connected joints. The expectation is that this action will prevent salty water from further eroding the structural members. However, such action will certainly alter the design of the bridge as originally conceived.

The Iowa City consulting firm NNW, Inc. has also recommended that the open steel deck be replaced with a laminated wooden deck, similar to the one originally in place, and that corrosion of the superstructure be controlled with annual spraying of fresh water. The City of Burlington is currently seeking funds to conduct the repair work needed on the bridge, which is beginning to show considerable deterioration of the substructure concrete in addition to the corrosion of steel structural members. Fortunately, however, the March 1995 inspection report of NNW, Inc. has estimated that with minor repairs and regular maintenance the Cascade bridge should serve the citizens of Burlington for another hundred years.

APPENDIX
IMPLICATIONS FOR FURTHER RESEARCH

Several questions concerning the Cascade Bridge arose during the research and writing of this report. Some of these questions, due to limitations in the scope of the Iowa Historic Bridges Recording Project, have remained unanswered. It is suggested that scholars interested in this bridge consider pursuing the following:

1. Why was the low bidder not awarded the contract?
2. What effect on the structural integrity of the bridge will welding of the pin-connected joints have?
3. What was the final cost of substructure construction?

SOURCES CONSULTED

City of Burlington Council Record 19, 295 (6 April 1896); 303, 317, 319, (20 April 1896); 320 (27 April 1896); 324, 327, 337-339 (4 May 1896); 357 (18 May 1896); located in the Des Moines County Courthouse, Burlington, IA.

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ADDENDUM TO
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This appendix is an addendum to a 12-page report previously transmitted to the Library of Congress.

APPENDIX: ADDITIONAL REFERENCES

Interested readers may consult the Historical Overview of Iowa Bridges, HAER No. IA-88: "This historical overview of bridges in Iowa was prepared as part of Iowa Historic Bridges Recording Project - I and II, conducted during the summers of 1995 and 1996 by the Historic American Engineering Record (HAER). The purpose of the overview was to provide a unified historical context for the bridges involved in the recording projects."